Some problems in the management of the Green and Golden Bell Frog *Litoria aurea* (Anura: Hylidae) at Coomonderry Swamp on the South Coast of New South Wales

Garry Daly
c/- North Nowra P.O., New South Wales 2541.

ABSTRACT

Coomonderry Swamp, the largest freshwater coastal wetland in New South Wales, lies 15 km north east of Nowra. The wetland and its catchment are utilized for a number of purposes including dairy farming, beef cattle production, turf farming, plant nurseries and a national park. Coomonderry Swamp provides habitat for several species of fauna currently recognized as endangered in New South Wales including the Green and Golden Bell Frog *(Litoria aurea)*. There have been several attempts to drain the wetland in order to convert the area to other land uses including dairying, a golf course and housing. Currently there is a proposal to rezone part of the wetland's catchment from rural to rural residential. All such proposals would compromise to some extent the habitat value of this significant wetland. If regional biodiversity is to be maintained planning authorities, need to adopt local environmental planning instruments that protect habitats identified as significant for rare and endangered species such as *L. aurea*.

INTRODUCTION

Litoria aurea has undergone a recent population decline in New South Wales and is now listed on part 1 of Schedule 12 of the amended *National Parks and Wildlife Act* as threatened. Currently, populations in New South Wales are scattered along the coast from Yuragir National Park (Clancy 1996) to Jervis Bay (Daly 1995a,b). In Sydney the species has been located at several heavily disturbed sites, including quarries (Cogger 1993; Greer 1994, pers. obs.). The colonization of fish-free quarries may be a response of *L. aurea* to the presence of Mosquito Fish (*Gambusia holbrooki*) in swamps that they previously utilized for breeding. The draining and filling of many freshwater wetlands during the last 35 years may also have driven *L. aurea* to constructed ponds.

There is a need to manage remaining coastal freshwater wetlands as they represent critical habitat for adult frogs and may also serve as breeding sites. Coomonderry Swamp provides an appropriate case study for the management of the *L. aurea's* natural habitat. The aim of this paper is to examine how one *L. aurea* habitat has been managed and to offer a range of conservation measures to preserve the existence of the species.

Coomonderry Swamp

Coomonderry Swamp (34°48'S, 150°44'E) is a 670 ha wetland 15 km north east of Nowra on the New South Wales south coast. It is the largest semi-permanent freshwater swamp on the New South Wales coast (Fig. 1) and represents 34% of this type of wetland in the state (Goodrick 1970). It is fed largely by ground water (Mitchell McCotter 1992). The swamp is a gazetted wetland (No. 370) under State Environmental Planning Policy (SEPP) No. 14 and 169 ha of it (25%) lies within Seven Mile Beach National Park (Mitchell McCotter 1992). This is one of the few national parks where *L. aurea* is known to occur. The Illawarra Regional Landscape and Environment Study (Department of Environment and Planning 1981) categorizes the wetland as IIc-Priority Protection requiring protection against polluting land uses.

Coomonderry Swamp is significant for *L. aurea* because it is the most extensive wetland in which the frog has yet been discovered in New South Wales (G. Daly, pers. obs.). Unfortunately the introduced Mosquito Fish (*Gambusia*) is widespread in the swamp, although the impact this predator of small tadpoles has had on the local frog population is unknown. To date the frog is known to occur on both the eastern and western sides of the wetland. On the eastern edge it occurs in swamp mahogany (*Eucalyptus robusta*) and blackbutt/bangalay (*E. pilularis*/*E. botryoides*) forest (Murphy 1994). On the western edge it occurs in cumbungi/spikerush (*Typha* spp/ *Eleocharis* sp.) and in farm dams containing kikuyu (*Pennisetum clandestinum*) and water primrose (*Ludwigia peploides*). Breeding behaviour and spawn have only been found on the western side of Coomonderry Swamp, in two farm dams which were fish free (Daly 1995a). Frogs were not present in a nearby dam which

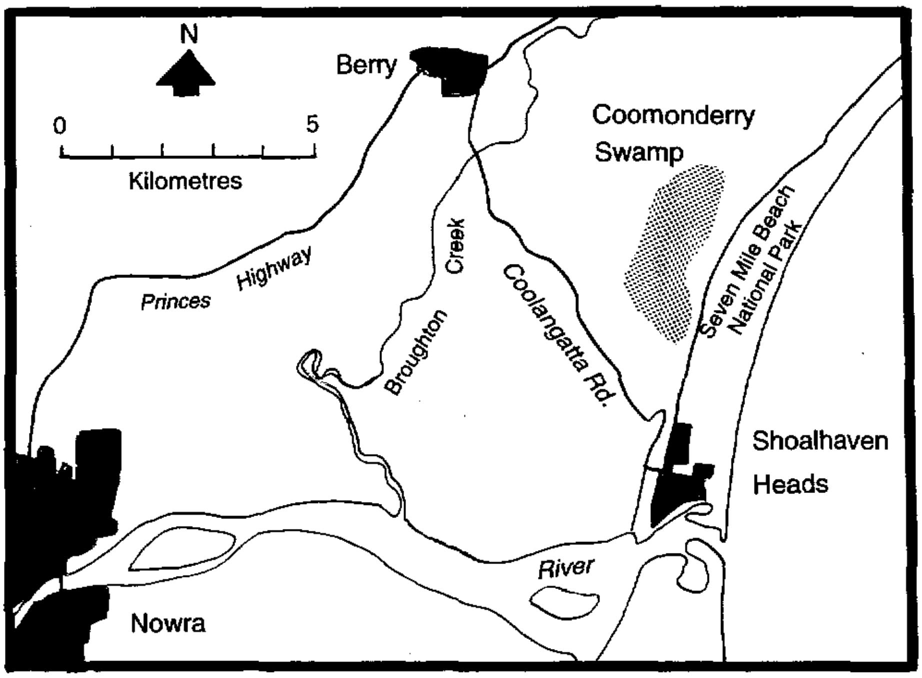

Fig. 1. Location of Coomonderry Swamp near Nowra, New South Wales.

contained Mosquito Fish. The fish-free water bodies around Coomonderry Swamp may be critical for the successful breeding of the frog in the area.

Coomonderry Swamp has an extensive area of natural habitat which is potentially suitable for *L. aurea*, and the wetland maintains a large population (Daly 1995a). The majority of the extant populations of *L. aurea* in New South Wales occur in coastal wetlands south of Sydney, particularly in the Wollongong-Kiama and Nowra Municipalities (G. Daly, pers. obs.). The fact that part of Coomonderry Swamp is in a National Park is significant since in New South Wales the species is now only known from three national parks: Yuraygir (Clancy 1996), Seven Mile Beach (Murphy 1994) and Jervis Bay Nature Reserve (Commonwealth controlled land) (Daly 1995b).

Threats to Coomonderry Swamp

Several threats to Coomonderry Swamp as a viable habitat for *L. aurea* are outlined below. They are listed in order to illustrate improvements which could be made in conservation practices for the species.

Recent environmental assessments have failed to consider adequately *L. aurea*. One report commissioned by the Shoalhaven City Council (Mitchell McCotter 1992) ignored amphibians totally, even though it concluded that the assessment provided sufficient information to satisfy the *Endangered Fauna (Interim Protection) Act* 1991. In other cases, development applications have been granted prior to a proper assessment having been made. Daly (1993) conducted a fauna assessment on land proposed for turf farming adjacent to Coomonderry Swamp. This land was previously evaluated by Mitchell McCotter (1992) as "unacceptable to development" and for zoning as Environmental Protection (7a). In future, environmental surveys should be undertaken, prior to consent, for all development in the vicinity of the swamp and *L. aurea* should be included in these surveys.

Much of the current land management near Coomonderry Swamp is inappropriate for sustaining *L. aurea*. For example, the siting of roads close to the wetlands, especially where they may traverse suitable frog habitat, can be a problem. A road killed, gravid female *L. aurea* was found close to the Bolong/Gerroa Road intersection (Daly 1995a). Future development that involve additional roads or an increase in traffic should be considered with respect to *L. aurea*.

The continued draining of land leads to an obvious loss of frog habitat. In the early 1900s various drainage canals were constructed across the Shoalhaven flood plain in an attempt to drain low-lying areas in order to make them useful for agriculture. Such drainage canals were subsequently enlarged in the 1960s and 1970s (Shoalhaven City Council 1992). In the Shoalhaven and adjacent Kiama Shires the following

Plate 6a. A pair of *L. aurea* in amplexus at Shoalhaven Heads, New South Wales.

Plate 6b. A road-killed *L. aurea.* In situations where roads occur close to breeding sites, vehicles may contribute to a significant source of mortality.

fresh water swamps have been drained: (1) Foys Swamp (adjacent to Coomonderry Swamp); (2) the extensive flood plains west of Coomonderry Swamp, extending from Coolangatta Mountain west to Bomaderry and north to Berry; (3) the extensive flood plains to the east and south-east of Nowra; (4) several unnamed swamps beside the Shoalhaven River (east of Ski Park, adjacent to bridge at Bomaderry and Ben's Walk); and (5) Omega Swamp (Kiama) (G. Daly, pers. obs.).

The preservation of *L. aurea* requires a re-examination of drainage canals. It may be appropriate to fill in canals to re-establish wetlands. The permanent canals which are required to keep the water table low after initial drainage also provide a potential route for Mosquito Fish to penetrate to isolated farm dams during flooding. At one site adjacent to Coomonderry swamp, a flood allowed Mosquito Fish and Goldfish *Carassius auratus* to enter a dam where *L. aurea* had spawned (Daly 1995a). No Bell Frog tadpoles were located in this pond after this event. These problems may be overcome by filling in drainage canals and altering dams so they are ephemeral.

Isolated dams adjacent to wetlands can also be rendered unsuitable for frogs by the deliberate introduction of fish into them. Concessional lot subdivision has resulted in the establishment of several small privately owned portions of land adjacent to the wetland, all of which have at least one dam. One lot has a dam in which the owners have placed Carp *Cyprinus carpio* and Mosquito Fish (C. Virtue, pers. comm.). Prior to the addition of these fish, the pond was utilized by *L. aurea* (C. Virtue, pers. comm.). Such small farm dams that have become populated by Mosquito Fish serve as a reservoir for colonization of new areas. There is also a strong possibility that additional species of exotic fish will colonize Coomonderry Swamp. Dams adjacent to Coomonderry Swamp should be inspected and if exotic fish are detected their owners should be encouraged to drain or poison them (Barlow *et al.* 1990).

Other exotic predators besides Mosquito Fish are also a potential threat to the frog. Bell Frogs are eaten by Foxes *Vulpes vulpes* (Mr. P. Meek, pers. comm.) and probably Cats *Felis catus.* The degree of impact this has on *L. aurea* is unknown.

Another potential threat to Coomonderry Swamp is mining. There are considerable resources of peat and sand within Coomonderry Swamp (Mitchell McCotter 1992). Immediately to the north of the wetland is a sand mine. The owners of this mine (Cleary Brothers) also have freehold title to the northern section of Coomonderry Swamp. The sand mining activities at Seven Mile Beach have resulted in the removal of native vegetation and the construction of a large permanent water body. The impact of this operation on *L. aurea* is unknown.

Rezoning land for subdivision has an obvious effect on frogs as this involves the removal of habitat and leads to an increase in roads and traffic. During 1995 the Shoalhaven City Council prepared a Local Environmental Plan (LEP). Coomonderry Swamp was excluded from this assessment because it is subject to a separate LEP. There has been some subdivision of land in the catchment of this wetland and there is a deferred application to rezone tracts of land to the north-west of the wetland to rural residential (G. Watson, Councillor Shoalhaven City Council, Minutes of the Lower Shoalhaven Catchment Management Meeting 2/5/95). The appropriateness of land use intensification is questionable in respect to *L. aurea* habitat.

Conservation Measures

Litoria aurea is a species which is difficult to conserve because it may make seasonal movements from cumbungi swamps through environments modified by humans to fish-free ponds for spawning (Daly 1995a). Adult frogs have different habitat requirements to tadpoles and hence conservation measures need to accommodate the animals' requirements at all stages of their life cycle.

An approach to conserving *L. aurea* at Coomonderry Swamp should include the following: (1) rezoning all of the Coomonderry Swamp wetland to National Park; (2) establishing a forum for effective liaison and co-operation with freehold land owners; (3) annual surveys of the size of the frog population; (4) annual monitoring of cumbungi swamps adjacent to core adult habitat; (5) eradication of Mosquito Fish, Carp and Goldfish via intermittent drainage of dams or poisoning (Barlow *et al.* 1990); (6) re-establishment of wetlands by filling in drainage lines; (7) construction of small dams adjacent to Commonderry Swamp to augment the number of spawning sites; (8) raising of locally-obtained tadpoles for subsequent translocation to Commonderry Swamp; (9) establishment of baiting programmes for foxes and cats in areas adjacent to the wetland; and (10) rezoning land adjacent to the wetland in order to minimize impacts of development on the *L. aurea* population.

Clearly, the continued natural existence of *L. aurea* in wetlands such as Commonderry Swamp will depend on a concerted and unified effort that involves at least State and Local Government, the National Parks and Wildlife Service of New South Wales, Catchment Management Committees, local landowners and experienced fauna consultants.

ACKNOWLEDGEMENTS

I thank P. Beck, R. Goldingay, A. Greer, G. Leonard, H. Nugent, T. van de Mortel and W. Osborne for their critical review of the manuscript and M. Murphy for his company in the field. This paper has benefited from discussions with W. Buttemer and L. Morgan.

REFERENCES

Barlow, C., Reynolds, L. F. and Bock, K., 1990. Fish in Farm Dams. Agfacts F3.1.1. New South Wales Agriculture and Fisheries: Sydney.

Clancy, G. P., 1996. The Green and Golden Bell Frog *Litoria aurea* in the Station Creek area of Yuraygir National Park. *Aust. Zool.* **30**(2): 214–17.

Cogger, H. G., 1993. Faunal Impact Statement. Green and Golden Bell Frog *(Litoria aurea)* occurring at Rosebery. Unpublished report prepared for State Authorities Superannuation Board of New South Wales, Sydney.

Daly, G., 1993. Fauna assessment "Turfo" turf farm, Coomonderry Swamp, Coolangatta. Shoalhaven Shire. New South Wales. Unpublished report prepared for "Turfco" Pty Ltd, Berry.

Daly, G., 1995a. Observations on the Green and Golden Bell Frog *(Litoria aurea)* (Anura: Hylidae) in southern New South Wales. *Herpetofauna* **25**(1): 1–9.

Daly, G., 1995b. Reptiles and Amphibians of Jervis Bay National Park. Unpublished report prepared for the Australian Nature Conservation Agency: Canberra.

Department of Environment and Planning, 1981. *Illawarra Region Landscape and Environment Study.* Department of Environment and Planning: Sydney.

Goodrick, G. N., 1970. A Survey of wetlands of coastal New South Wales, CSIRO: Canberra.

Greer, A. E., 1994. Environmental Impact Statement for the proposed development works at the Homebush Bay brick pit. Unpublished report prepared for Property Services Group: Sydney.

Mitchell McCotter, 1992. Proposed re-zoning of Coomonderry Swamp: environmental assessment. Unpublished report prepared for Shoalhaven City Council: Nowra.

Murphy, M. J., 1994. Reptiles and amphibians of Seven Mile Beach National Park, New South Wales *Herpetofauna* **24**(2): 24–30.

Shoalhaven City Council, 1992. State of the Environment.